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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/015,433	12/12/2001	Martin Kranz	5318/CALB/COPPER/PJS	5742

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APPLIED MATERIALS, INC.
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EXAMINER	
TRAN, BINH X	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 12/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/015,433	KRANZ ET AL.
	Examiner	Art Unit
	Binh X Tran	1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,7-11,18 and 32-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *18 and 38-42* is/are allowed.

6)☒ Claim(s) *1-5,7-11 and 32-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-5, 7-9, 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subrahmanyan et al. (US 6,107,192) in view of Parkhe (US 6,033,482) and Chen et al. (US 6,132,813).

Subrahmanyan discloses a process comprises the step of:

disposing a substrate on a substrate support in a process chamber (Fig 2-4);

exposing the substrate to a pre-cleaning process comprising forming a plasma from the gas mixture consisting of non-reactive gas (i.e. He, Ar) and a reactive gas H_2 (col. 9 lines 50-60).

Subrahmanyan fails to disclose the step of cooling the substrate to a temperature of 100 °C or less. Parkhe teaches to cooling the substrate before activating the plasma in the pre-cleaning process (col. 3 lines 40-67). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Subrahmanyan in view of Parkhe by cooling the substrate because it will stabilize the substrate temperature and result in effective cleaning.

Subrahmanyan and Parkhe differ from the invention by the specific temperature range. However, Parkhe clearly disclose that temperature is a result effective variable and it can be control via heat transfer medium (col. 3 lines 40-50, col. 4 lines 4-15). In a pre-cleaning process, Chen discloses the temperature range between 5-80 °C is effective to remove contamination (read on applicant's range of "100 degree Cesium or less" See table 1 in col. 5). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal temperature as an expected result.

Respect to claim 2, Subrahmanyan discloses the step of electrostatically chucking the substrate to the substrate support member (col. 5 lines 26-30). Respect to claims 3-5, Parkhe discloses cooling the substrate comprises flowing a gas or heat

transfer fluid through the substrate support or transferring heat from the substrate through a thermo-electric device (See Fig 1, col. 4). Respect to claim 7, Subrahmanyan discloses the step of etching/removing CuO (i.e. native copper oxide) from the substrate (See col. 9 lines 58-62). Respect to claim 8, Subrahmanyan discloses inductively coupling about 300 Watts to the plasma, and bias the substrate support member with 10 Watts (within applicants' range, See col. 9 lines 55-60). Respect to claim 9, Subrahmanyan discloses reducing native oxides (col. 7 lines 15-20). Respect to claim 32, Subrahmanyan discloses the non-reactive gas is selected from the group consisting of argon, nitrogen and helium (col. 9 lines 56-57).

4. Claims 10-11, 33-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Denning et al. (US 6,451,181) in view of Parkhe and Asaka (US 5,236,537).

Denning disclose a process for pre-cleaning aperture on a substrate, the process comprises the step of:

disposing a substrate on a substrate support in a process chamber (Fig 2);

electrostatically chucking the substrate to the substrate support member (col. 6 lines 20-25)

exposing the substrate to a pre-cleaning process comprising forming a plasma from the gas mixture consisting of non-reactive gas (i.e. Ar or Xe) (col. 11 lines 10-30).

Denning fails to disclose the step of cooling the substrate to a temperature of 100 °C or less. Parkhe teaches to cooling the substrate before activating the plasma in the pre-cleaning process (col. 3 lines 40-67). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Denning in view of Parkhe by

cooling the substrate because it will stabilize the substrate temperature and result in effective cleaning.

Denning and Parkhe differ from the invention by the specific temperature range. However, Parkhe clearly disclose that temperature is a result effective variable and it can be control via heat transfer medium (col. 3 lines 40-50, col. 4 lines 4-15). In a pre-cleaning process, Asaka discloses the temperature at about 25 °C is effective to remove contamination (read on applicant's range, col. 12 lines 60-65). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal temperature as an expected result.

Respect to claim 11, Denning discloses the inductively coupling about 300 Watts or greater and biasing the substrate support to 100 Watts or less (within applicant's range, col. 13 lines 50-55). Denning teaches to regulate the pressure, but Denning fails to disclose specific chamber pressure value. However, both Denning and Parkhe discloses that pressure is a resulting effective variable by controlling/regulating the chamber pressure (Denning col. 7 lines 1-7; Parkhe col. 4 lines 49-55). In a pre-cleaning process, Asaka discloses a chamber pressure of 0.1 Pa (0.1 Pa = 0.75 mtorr, within applicant's pressure range of "0.5 to 100 mtorr"; See col. 12 lines 60-62). Asaka further teaches a change chamber pressure will result a change in the etching speed (Fig 4). The result effective variable is commonly determined by routine experiment.

The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal pressure as an expected result.

Respect to claim 33-34, Denning teaches the non-reactive gas is argon (col. 11 lines 10-15). Respect to claims 35, Parkhe teaches to flow a gas through the substrate support member (chuck 104) to an area between the substrate support member and the substrate (i.e. passage way 109, See Fig 1). Respect to claims 36-37, Parkhe teaches to transfer heat from the substrate through a thermoelectric device (161) or heat transfer fluid (130).

Allowable Subject Matter

5. Claims 18, 38-42 is allowed.

6. The reason for allowance was discussed in previous office action.

Response to Arguments

7. Applicant's arguments filed 9-21-2004 have been fully considered but they are not persuasive.

The applicants argue that "Parkhe does not describe cooling the substrate before activating plasma in a pre-cleaning process, as asserted by the examiner". According to applicants, Parkhe only teaches "the substrate must be temperature controlled prior to plasma being ignited in the chamber". The examiner disagrees. Parkhe clearly teaches to control the temperature of the substrate prior igniting the plasma. In column 5 lines 9-13, Parkhe wrote "The wafer 102 may undergo pre-plasma process such as

heating or cooling by flowing backside gas from the heat transfer gas supply 130 through the passage 109". Thus, the examiner still maintains that Parkhe teaches to cool the substrate before activating plasma.

The applicants further argue that "Parkhe does not teach or suggest that cooling a substrate prior to cleaning results in effective cleaning". The examiner disagrees. As discuss above, Parkhe teaches to perform temperature control (i.e. cooling or heating) before activating plasma. Further, in column 3 lines 40-41, Parkhe wrote "For effective cleaning, the wafer must be able to be chucked and temperature controlled prior to a plasma being ignited in the chamber". Thus, the examiner still maintains that Parkhe teaches that cooling a substrate prior to cleaning results in effective cleaning.

Respect to claims 1-5, 7-9 and 32, applicants argue that "the combination of Subrahmanyan, et al. and Parkhe does not teach or suggest that temperature is a result effective variable to be optimized for a pre-cleaning process". The examiner disagrees. Parkhe clearly discloses that temperature is a result effective variable. In column 4 lines 34-55, Parkhe teaches to use sensor monitor the temperature of the chamber and to use the controller (160) to control the temperature. Further, in column 2 lines 10-15, Parkhe discloses that the temperature parameter is depended on the potential difference of the plasma process.

Respects to claims 10-11, applicants argue that Parkhe does not teach that temperature is a result effective variable. Again, the examiner disagrees. As discussed above, Parkhe clearly discloses that temperature is a result effective variable. In column 4 lines 34-55, Parkhe teaches to use sensor monitor the temperature of the chamber

and to use the controller (160) to control the temperature. Further, in column 2 lines 10-15, Parkhe discloses that the temperature is directly depended on the potential difference of the plasma process. Thus, the examiner still maintains that Parkhe teaches the temperature is a result effective variable.

The applicants also argue that "Asaka does not teach or suggest that the substrate temperature is a result-effective variable". The examiner disagrees. Asaka clearly teaches the substrate temperature is depended on the kind of gas being use in the chamber. For example, if hydrogen gas source is used, the temperature should be 400 °C for the pre-cleaning process. If argon gas was used, the temperature should be 25 °C for the pre-cleaning process (col. 12). Asaka further discloses by performing the pre-cleaning process at a specific temperature, "the stability and reproducibility of the etching rate was improved over the case of original embodiment, where no pre-cleaning treatment was perform" (col. 13 lines 13-16). Thus, the examiner still maintains the temperature is a result effective variable.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

Binh X. Tran